

temperatures. At first it had been my intention to have made this determination of temperature in the same general way as the other; but, with my indifferent command of the language, at the beginning of the investigation I had the greatest difficulty in making my subjects understand that the operation would result in no bodily harm, which I had no difficulty in understanding they anticipated, by the perspiration oozing from every pore, a look of piteous agony in their faces, and eyes fearfully watching for the first suspicious movement on my part. I naturally concluded that much misery would be saved, without in any way affecting the accuracy of the result, by determination from the individual rather than the mass. The determination was made by placing the bulb of a thermometer well underneath the tongue, and keeping the mouth closed till the mercury column reached its highest and stationary point.

Our mean temperatures were 98.1° F. for winter (December), and 97.7° for summer (July), whilst theirs were 100.2° and 98.4° respectively. I cannot help thinking that part of this large difference is owing to our Eskimo having changed his diet, by the rations we allowed him, towards the summer season.

In determining the mean heights, I considered it advisable to exclude palpable extremes, as my measurements were necessarily from a limited field. The result was a mean height for the men of 5 feet 3.9 inches; for the women, within a very small fraction of 5 feet.

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The Observatory, Quebec, July 18.

Chrome considered as a Poison.

IN *Science* (viii. p. 178) is printed an extract from a paper written by Dr. Charles Harrington, and which appeared in the *Boston Medical and Surgical Journal* (cxv. No. 6). Dr. Harrington's paper was an original communication made to the Massachusetts Medical Society, and was read at the annual meeting of June, 1886. The society recommended the paper for publication. It thus appears with the indorsement of two journals and one medical society, all of the very first standing and ability.

This paper concerns itself with chromium considered as a poison to the animal body, and cites four cases, all of whom were Dr. Harrington's patients: 1st, A woman who made caps from blue cloth. She was attacked by ulceration over most of the body, with swellings, and with constitutional disturbances which had not subsided at the end of two years. The cloth proved to contain a "large amount of chromium." To dust arising from it the symptoms are assigned. 2d, The case of a clergyman whose hands ulcerated. His gloves proved to contain "a large amount of chromium," and to this the ulcers are attributed. 3d and 4th, Two young boys who were attacked with nausea, vomiting, fever, delirium, and convulsions. Their new suits of clothing were examined, and proved to contain "chromium in great abundance." The paper states that its compounds, when taken internally, produce symptoms similar to those described. One child sucked his fingers, and the other bit his nails. And thus the chrome-poison was introduced. The dejecta from the elder of the boys proved to contain "traces of chromium, and thus established the diagnosis of poisoning."

The well-written and highly indorsed paper, curiously enough, does not offer the slightest evidence that chromium or any of its compounds, in any quantity, however large or small, can injuriously affect the animal body. Furthermore, there is no reliable tradition or literature to that effect. And yet chrome-dyes have been in general use since 1828 at least, the American consumption alone being thousands of tons annually. In fact, so general is their use, that chromic oxide may be found in almost any piece of cloth which may happen to be at hand.

In the entire absence of any reliable literature pertinent, I was led to make studies as to the poisonous effects of chrome-salts. In the weaving of fabrics, the yarn suffers a constant succession of shocks and scrapings, which must detach any thing like dust which may adhere to it. If, then, dust from chrome-dyed yarn had any poisonous effects, weavers ought to have some knowledge of it. Inquiries were set afoot in three mills in Philadelphia, and from none was there reported any injurious effect from such dust. If any

existed, it was not known to the weavers. This seemed important.

Similarly, and in the same way, dyers were questioned, and none of them had any knowledge of injury from chrome. Such operatives have their hands and arms in chrome-dyes at almost any hour of the day, and therefore their replies seemed interesting.

Of even more importance are the workers in a chrome-factory, one which has been in operation over fifty years. Here are produced the alkali bichromates which dyers use. The operatives (some hundreds in number) live in an atmosphere quite heavily charged with alkali chromate dust, visibly charged. Yet these people are as healthy as those in other occupations. As a matter of fact, there may any day be seen at this factory several pensioners, worn out in the service, and now too old to do more than the semblance of labor.

But this is to be said, every man who works exclusively within the factory has the nasal septum partially destroyed in from eight to twenty weeks. The cautery then ceases, and there is no further inconvenience. And, further, if strong chrome-liquors, or much chrome-dust, be allowed to get upon any abrasion of the skin, they are apt to produce sores; and, if these sores be treated to more chrome, they will continue to suppurate, and will produce sores with vertical walls, having the appearance of syphilitic chancres; but if a sore be protected by salve, or otherwise, it heals like any other one would.

Through the courtesy of a practising physician, the health of these bichromate-makers was discussed at a meeting of a medical society whose members had the care of them. No chrome-disease or chrome-poisoning was known to those physicians.

To sum up so far: there is not known to exist, among the workers in any of the forms of chrome, any chrome-disease or chrome-poisoning from contact, from inhalation, or otherwise. This much established, there was no risk in the following experiments:—

1. Three healthy men were exposed for four hours to an atmosphere containing vapors from boiling sodium bichromate,—vapors visible in a beam of sunlight.
2. Two healthy men were exposed twenty minutes to an atmosphere containing visible clouds of dust of neutral sodium chromate.
3. The lower half of a shirt-sleeve was saturated with a ten-percent solution of potash bichromate, and then bound around the arm from wrist to elbow. It remained thus in contact with the skin three hours, and was kept moist.
4. A piece of white cotton cloth was dyed black in the ordinary way, by sumac, iron nitrate, chrome, and logwood. After washing in cold water alone, and passing through a clothes-wringer, a piece of it, eight inches wide and ten inches long, was pinned to the inner side of the undershirt, and worn in contact with the skin for four hours on a hot day.

No experiments were made to ascertain the effects of wearing chrome-dyed clothing, only because the writer was able to recall precisely the cases of so many men, women, and children who had done that without any deleterious results, so far as known. None of them, at least, were affected in any of the manners described as due to chrome-poisoning, in Dr. Harrington's communication. No unpleasant results followed any of the experiments mentioned. No one of the subjects has suffered in the slightest. The time elapsed is more than a month.

In the daily papers of July 12 of this year, appeared the report of a coroner's jury which considered the cases of several persons who died in Philadelphia during the years 1885, 1886, and 1887, from eating buns, it was supposed, made by Palmer, a baker, who had put into them chrome-yellow. The ages of the victims were from three years to twenty-four years, among them being seven of Palmer's own family. He did not deny having put lead chromate in the buns. It was, indeed, in evidence that eighty per cent of Philadelphia bakers so used it. The testimony of Dr. Stein, Dr. Stewart, and Dr. Stark, the attending physicians upon the particular subjects under consideration, was that the symptoms were those of lead-poisoning, and that they set about to search for the source. They found it in Palmer's bakery,—the lead chromate which he put in the buns. The viscera of victims, after death, were submitted to Dr. Leffman,

the chemist, who found lead in them, and testified that the subjects died of lead-poisoning. The newspaper reports say, "The evidence was conclusive that several members of the Diebel and Palmer families died of lead-poisoning." The verdict of the jury was, that "the deaths of the four persons were undoubtedly due to chronic lead-poisoning, and that the poisoning resulted from the use of chromate of lead as a coloring-matter in buns and other bread-stuffs." The only allusion to chrome-salts in the entire reports, as given in two newspapers, was made by Dr. Leffman, who said, "The traces of chromium had disappeared." We have here four cases well authenticated, in which lead chromate produced death,—produced it by chronic lead-poisoning, and not by any action of the chromium trioxide present.

The theory of antidotes, as understood by this writer, is that substances insoluble in any of the juices of the animal body are harmless as poisons. If we do not accept this as a fundamental proposition, it is difficult to see how we reasonably can employ any antidote supposed to act upon that principle. Chromic acid is a very active oxidizer. In contact with organic matter, it is quickly reduced to chromic oxide (a compound insoluble in any of the juices of the animal body). It is a destroyer of organic tissues, therefore. The action of both normal and acid alkali chromates is similar to chromic acid. They destroy organic matter by oxidizing it, chromic oxide being precipitated. Chromic acid and soluble chromates are then poisonous in the same sense as are sulphuric acid and nitric acid. Chromic oxide is harmless.

Concerning the Philadelphia cases mentioned, the writer cannot even pretend to speak with any authority. Any one, however, familiar with the oxidizing action of chromic-acid salts, and who is accustomed to making combustions with lead chromate, would not find much difficulty in believing that the small quantity of lead chromate taken by any one victim was reduced while in contact with organic matter in the stomach and intestines, chromic oxide passing out with the dejecta, and lead oxide being left to produce its cumulative poisonous effects.

When one states that the insoluble modifications of chromium are in any way poisonous to the animal body, the burden of proof rests upon him. The soluble salts (the alkali chromates) do, however, produce sores and sloughing under certain conditions: (1) if they fall in quantities upon an abrasion of the skin, or (2) upon the delicate mucous membrane. Speaking generally, a solution containing 150 grams of an alkali chromate in one litre of water is scarcely strong enough to produce sores upon the hands. Again, generally, alkali chromate dust which is just visible without direct sunlight is harmless, unless one should remain in it for some weeks. When such dust falls upon the mucous membrane, it is quickly reduced by the secretion it finds there, and chromic oxide is precipitated. The membrane is not attacked. There can be no doubt that Dr. Harrington found in the clothing he examined, the large quantities of chromium salts mentioned by him. It would have been rather strange if he had not, since most cloth is chrome-dyed, and contains about eight-tenths of one per cent chromic oxide in its fibre. Had he examined further, equally certain, he would have found iron, cellulose, keratin, and some other organic products. Why not assign to one or all of them the maladies of the patients mentioned? So far as his paper gives evidence, or so far as I know, cellulose is equally as poisonous as the insoluble chrome-dye on yarn. We should risk little in saying this is true so far as any one knows. Before we say otherwise, we should offer such proofs as would lead a cautious man to accept the statements.

To those who read the communication alluded to, it may be of interest to know that a suit of clothing for a small boy will lose in weight about three hundred and forty milligrams in a week. Of this, about eight-tenths of one per cent is chromic oxide, when the clothing is chrome-dyed. Such clothing then loses about two and seven-tenths milligrams of chromic oxide in one week. How much of this latter the boy would be likely to inhale as dust, and what injury it would do him, are matters about which I have no information to offer. If it were arsenic, and he inhaled the whole of it in one day, and twenty times as much more, it might possibly sicken him.

Five hundred milligrams of the chrome-dyed cotton cloth before mentioned was ground between the teeth of a healthy man, and

slowly swallowed. It produced no effect which could be detected. This cloth contained four milligrams of chromic oxide. Such a small quantity was taken only because of the desire to test the effects of minute quantities. The only inconvenience resulting from an attempt to eat a yard square of such cloth would be in masticating it. Even between strong molars, it is really difficult to grind.

To sum up, finally, the writer has not been able to show that chrome-dye, or indeed any modification of chromium, is in any way poisonous to the human body. The continuation of these studies is left to others better fitted to pursue them, and with the sincere hope that the subject will not be allowed to die of neglect. The matter intimately concerns the general welfare. WM. GLENN.

Baltimore, July 21.

Distillery-Swirl as a Food for Milch-Cows.

THE interest in this subject, developed by the recent discussion in *Science*, prompts me to give its readers some additional points of interest. Until within the past four years, the practice of feeding distillery-waste on Long Island was very prevalent. Although the ordinances of the city of Brooklyn have for years forbidden the use of this food, no systematic effort was made to stamp it out previous to the year 1883. At that time it was used very generally in Brooklyn and its suburbs, especially during the winter months. Since then it has been almost entirely discontinued through the efforts of the Health Department.

It is the almost unanimous opinion of cow-keepers who have fed swirl and dry feed, that the cows do better without swirl; by which they mean that they are healthier and less subject to diseases. This statement is of value, as it is the result of a practical trial extending over several years of time, and under conditions otherwise the same. It is the verdict of a large number of stables where the experiment has been tried by different men. To me, this testimony is conclusive as to the question of this food upon the health of the cows fed upon it. Tuberculosis and pleuro-pneumonia are more prevalent in stables where swirl is fed than where 'grains,' meal, and hay are fed. This statement is based upon personal observation, and the testimony of the dairymen themselves.

A word as to the manner of feeding swirl. The cows do not take kindly to this food, and must be starved to it, as a rule. Consequently, when it is to be fed, it is necessary to withhold other food, for a time at least. I have rarely seen it mixed with other food, and, in fact, the testimony of milkmen in this vicinity is that it is next to impossible to get cows to eat a mixture of swirl and other food, excepting hay. The digestion of cows fed upon swirl soon suffers derangements that prevent their eating such other food. Whenever it is fed at all, it is claimed that it must constitute almost the only food,—and thus it was fed in this vicinity,—when fed at all. As all advocates of swirl as food for milch-cows seem to make their advocacy rest upon a liberal supply of other food with it, it becomes an important point to determine whether cows will eat hot swirl, and cold meal or grain, at the same time. The experience of Long Island dairymen seems to indicate that success in this direction is doubtful, and prejudicial to the supply of milk as well as to the health of cows.

Statements have been made from time to time that distillery-waste contains alcohol and fusel oil, and that these alcohols have a bad effect upon the animals. This is an error. Both alcohol and fusel oil are separated from the waste as completely as possible; and my analyses have failed to reveal more than mere traces of either.

Sensational statements have been made that the tails of cattle fed upon this food atrophy and fall off. This statement is based upon the results of anti-pleuropneumonic inoculation seen in such stables. From the prevalence of pleuro-pneumonia among cattle fed upon this hot feed, the owners have for years resorted to a clumsy method of inoculation, in the tail, with a slice of diseased lung. In a considerable number of cases, septicæmia results, necessitating an amputation of the tail. The loss of the tails has nothing to do with the food.

When cows are kept most of the time in stalls, and fed upon this hot food, they become feverish. The temperature usually ranges from 101.5° F. to 102.5° F. This must be regarded as an